CLAIMS

1. An electrolyte membrane-electrode assembly comprising a pair of electrodes and a hydrocarbon-based solid polymer electrolyte membrane sandwiched therebetween wherein the glass transition temperature of the electrolyte membrane in a dry state is not lower than 160°C and the maximum water content of the electrolyte membrane is within the range of from 10% to 120%.

2. The electrolyte membrane-electrode assembly according to claim 1, wherein the periphery of each of the pair of electrodes is formed of a sealing member.

3. The electrolyte membrane-electrode assembly according to claim 1, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity (IEC) within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more, and in which electrolyte membrane the water absorption at 80°C (W80°C), the water absorption at 25°C (W25°C) and the ion exchange capacity (IEC) satisfy the following formula (1):

$$(W80°C/W25°C) \leq (ICE) + 0.05 \quad \text{(formula (1))}$$

W80°C: water absorption (% by weight) at 80°C

W25°C: water absorption (% by weight) at 25°C

IEC: ion exchange capacity (meq/g)

4. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used that comprises a sulfonic acid group-containing hydrocarbon-based solid polymer compound which is a hydrocarbon-based solid polymer having a sulfonic acid group content (an ion exchange capacity based on the polymer structure) of 2.0 meq/g or more and which exhibits a moisture absorption (λ)

defined as the number of water molecules per sulfonic acid group under an atmosphere at 80°C and 95% relative humidity of a value less than a relation (sulfonic acid group content)×6 - 2.

5. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more and in which the water absorption at 80°C of the electrolyte membrane (W80°C) and the ion exchange capacity satisfy the following formula (2):

$W80°C < 4.0\times(IEC)^{5.1}$ (formula (2))

W80°C: water absorption (% by weight) at 80°C

IEC: ion exchange capacity (meq/g)

6. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more, and in which electrolyte membrane the water absorption at 80°C (W80°C), the water absorption at 25°C (W25°C) and the ion exchange capacity satisfy the following formula (3):

$(W80°C/W25°C) \leq 1.27\times(ICE) - 0.78$ (formula (3))

W80°C: water absorption (% by weight) at 80°C

W25°C: water absorption (% by weight) at 25°C

IEC: ion exchange capacity (meq/g)

7. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane

having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more, and in which electrolyte membrane the volume at 25°C and 65% relative humidity (V1), the volume after immersion in water at 25°C (V2) and the ion exchange capacity satisfy the following formula (4):

$(V2/V1) \leq 1.05\times(IEC) - 0.38$ (formula (4))

V1: volume (cm^3) at 25°C and 65% relative humidity

V2: volume (cm^3) in 25°C water

IEC: ion exchange capacity (meq/g)

8. The electrolyte membrane-electrode assembly according to claim 1, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more and in which the tensile breaking strength (DT) measured in 25°C water and the ion exchange capacity satisfy the following formula (5):

$DT \geq 135 - 55\times(IEC)$ (formula (5))

DT: tensile breaking strength (MPa)

IEC: ion exchange capacity (meq/g)

9. The electrolyte membrane-electrode assembly according to claim 8, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane composed of a substantially single compound and exhibits a tensile strength of 40 MPa or more under an atmosphere at 20°C and 65% relative humidity and also exhibits a tensile strength measured in 25°C water of 30 MPa or more.

10. The electrolyte membrane-electrode assembly according to claim 8, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange

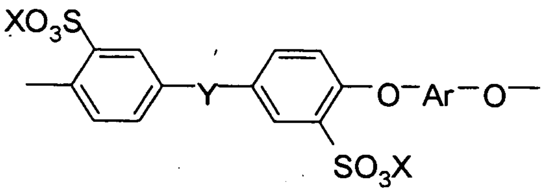
membrane composed of a substantially single compound and exhibits a tensile strength of 40 MPa or more under an atmosphere at 20°C and 65% relative humidity and which exhibits a difference between the tensile elongation measured in 25°C water and the tensile elongation measured in an atmosphere at 20°C and 65% relative humidity of 150% or less.

11. The electrolyte membrane-electrode assembly according to claim 8, wherein an electrolyte membrane is used which is a non-perfluorocarbon sulfonic acid-based hydrocarbon-based ion exchange membrane for fuel cells using liquid fuel and which electrolyte membrane exhibits a difference of 20% or less between the methanol permeation coefficients measured before and after the immersion of the ion exchange membrane in a 5 mol/l aqueous solution of methanol for 20 hours.

12. The electrolyte membrane-electrode assembly according to claim 11, wherein an electrolyte membrane is used which is a non-perfluorocarbon sulfonic acid-based hydrocarbon-based ion exchange membrane for fuel cells using liquid fuel, which electrolyte membrane exhibits a difference of 20% or less between the methanol permeation coefficients measured before and after the immersion of the ion exchange membrane in a 5 mol/l aqueous solution of methanol for 20 hours, and which electrolyte membrane has been subjected to a treatment of immersion in a solvent at a temperature of 80°C or higher.

13. The electrolyte membrane-electrode assembly according to any one of claims 1 to 12, wherein a poly(arylene ether)-based compound including a constituent represented by general formula (1) and a constituent represented by general formula (2) is used as the organic polymer forming the electrolyte membrane:

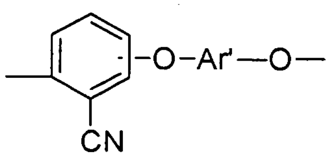
[chem. 8]



(1)

(in general formula (1), Ar represents a divalent aromatic group, Y represents sulfone group or a ketone group, and X represents H or a monovalent cationic group);

[chem. 9]



(2)

(in general Ar' represents a divalent aromatic group).

14. A fuel cell using the electrolyte membrane-electrode assembly according to any one of claims 1 to 12

15. A fuel cell using the electrolyte membrane-electrode assembly according to claim 13.

16. A method for producing an electrolyte membrane-electrode assembly by joining a hydrocarbon-based solid polymer electrolyte membrane and a pair of electrodes, wherein the hydrocarbon-based solid polymer electrolyte membrane is joined with the electrodes by hot pressing while the content of water contained in the hydrocarbon-based solid polymer electrolyte membrane is within the range of from 10 to 70% of the maximum water content of the hydrocarbon-based solid polymer electrolyte membrane.

17. The method for producing an electrolyte membrane-electrode assembly

according to claim 16, wherein the hydrocarbon-based solid polymer electrolyte membrane is provided with moisture through the holding of the hydrocarbon-based solid polymer electrolyte membrane in an atmosphere where the humidity and/or the temperature is controlled.